2. ROBERT BENSLEY: AN ALTERNATIVE APPROACH TO FRACTIONATION

In changing his focus to normal cells, Claude drew close to the work of a more senior investigator, Robert Bensley of the University of Chicago (apparently Claude was initially unaware of Bensley's work). Just a couple of years earlier, Bensley had arrived at – and applied – the idea of using centrifugation as a means of separating mitochondria from cells. Bensley was a traditional cytologist whose career spanned the first four decades of the twentieth century. He started to explore cell staining techniques while recovering from a hunting accident in his early teens that cost him one of his legs. Already in the first decade of the twentieth century, Bensley was conducting research on mitochondria and the Golgi apparatus. In particular, he further developed procedures for fixing cells with acetic-osmic-dichromate and staining them with anilin-acid fuchsin and methyl green and copper-chrome-hematoxylin that proved useful for targeting mitochondria. Bensley stands out from the other major cytologists active in the first decades of the twentieth century, though, in that late in his career he pioneered a means of bridging from morphology to chemistry. This was necessary if the structural decomposition of the cell offered by cytologists was ever to be linked to a functional decomposition (especially to the level of biochemical reactions). Whereas we saw in Chapter 3 that his former student Cowdry abandoned research on mitochondria in the 1930s, having become pessimistic about the prospects for finding such a bridge, Bensley pursued his idea with two of his last graduate students, Isidore Gersh and Normand Hoerr.

As discussed in the previous chapter, Gersh (1932) revived and simplified Altmann's procedure for fixing cells without chemical reagents by freeze-drying. Bensley and Gersh (1933b) used the technique to test many older claims about the effects of different solvents and heat on mitochondria. Many of the fat solvents, such as acetone, had no effect on mitochondria. On the other hand, water, 0.02% ammonia solution, and artificial gastric juice dissolved them. Bensley and Gersh interpreted this as showing that "the main mass of the mitochondria substance is protein in nature" (p. 230). Bensley together with Hoerr then took the major step of employing centrifugation to isolate mitochondria from fresh liver tissue preparations. They prepared specimens by perfusing the liver with salt solution, then grinding it in a mincing machine and pushing the result through a sieve of cheesecloth.[4] Several successive

[4] This paper, which reported results that did not rely on the freeze-drying method, appeared as the sixth in a series entitled "Studies on cell structure by the freezing-drying method." The connection